

## Claims

1           1.     A galvanizing roll assembly intended to be submerged in molten  
2 metal such as molten zinc, molten aluminum or mixtures thereof, said roll  
3 assembly comprising:

4                     an arm;

5                     a strip-engaging roll having a trunnion;

6                     a self-aligning bearing supporting the trunnion on the arm,  
7 said self-aligning bearing including a roller-bearing;

8                     said arm, said self-aligning bearing, said roll and said  
9 trunnion each comprising alloy materials that present low solubility with a  
10 particular molten metal in which they are to be submerged, said alloy materials  
11 having a high hardness,  $R_c > 25$ , at the molten metal operating temperature.

1           2.     A galvanizing roll-assembly as defined in claim 1, in which the alloy  
2 materials comprise by weight:

Percent		
.30	< Carbon <	1.80
0.0	< Chromium <	12.0
3.0	< Tungsten <	14.0
3.0	< Molybdenum <	14.0
20.0	< Iron <	50.0
0.0	$\leq$ Vanadium <	4.0

0.0  $\leq$  Niobium < 4.0

4.0  $\leq$  Cobalt < 20.0

0.0  $\leq$  Boron < 1.0

0.0  $\leq$  Manganese  $\leq$  1.0

0.0 < Silicon < 3.0

3. A galvanizing roll assembly intended to be submerged in molten metal, comprising:

an arm;

a strip-engaging roll having a trunnion member, the trunnion member having a trunnion axis;

a self-aligning bearing supporting the trunnion member on the arm for rotation about the trunnion axis, said self-aligning bearing including a roller-bearing,

the trunnion member having an outer cylindrical bearing surface;

the arm having a bearing housing member having an opening with an inner cylindrical bearing surface, for receiving the trunnion member in a generally coaxial position;

a plurality of elongated rollers disposed between the trunnion member and the bearing housing member, the rollers each having a longitudinal axis supported parallel to the trunnion axis; and

17                   a roller carrier having an elongated recess for receiving  
18 each of the rollers for rotation within a respective recess, the roller carrier being  
19 connected to one of said members such that the rollers roll with the other of said  
20 members.

1           4.     A galvanizing roll assembly as defined in claim 3, in which each of  
2 the recesses has an open, partially cylindrical recess wall, each of the rollers  
3 having a cylindrical wall, an annular clearance between each of the rollers and  
4 its respective recess wall for passing a hydrodynamic lubricating molten metal  
5 film between the roller and the recess wall as the roller is being rotated in a bath  
6 of a molten metal.

1           5.     A galvanizing roll assembly as defined in claim 3, in which the  
2 trunnion member is attached to the roll to rotate therewith.

1           6.     A galvanizing roll assembly as defined in claim 3, in which the arm  
2 assembly has self-aligning capability.

1           7.     A galvanizing roll assembly as defined in claim 3, in which the self-  
2 aligning bearing, including the trunnion member, the bearing housing member,  
3 and the plurality of elongated rollers are each formed of an alloy material that is  
4 relatively insoluble in molten zinc, molten aluminum, or mixtures thereof, and

5 contain an alloy material with a hardness  $R_c > 25$  at the molten metal operating  
6 temperature.

1 8. A galvanizing roll assembly as defined in claim 7, in which the alloy  
2 material includes an alloy material comprising by weight:

Percent		
.30	< Carbon <	1.80
0.0	< Chromium <	12.0
3.0	< Tungsten <	14.0
3.0	< Molybdenum <	14.0
20.0	< Iron <	50.0
0.0	$\leq$ Vanadium <	4.0
0.0	$\leq$ Niobium <	4.0
4.0	$\leq$ Cobalt <	20.0
0.0	$\leq$ Boron <	1.0
0.0	$\leq$ Manganese $\leq$	1.0
0.0	< Silicon <	3.0

1 9. In a galvanizing roll assembly having a supporting arm, a roll  
2 rotatable about a roll axis, and a bearing apparatus useful for supporting the roll

for transferring a heated steel strip in a bath of molten zinc, molten aluminum or mixtures thereof, said bearing apparatus comprising:

a trunnion member, carried on the supporting arm, the trunnion member having a longitudinal trunnion axis fixed with respect to the arm;

a self-aligning bearing means carried by the roll and supported by the trunnion member such that the roll rotates with respect to the trunnion member; including:

a housing;

first annular bearing structure movably mounted in the housing and having a cylindrical inner surface of a low friction material slidably mounted on the trunnion member, and an outer surface having an annular partially spherical bearing surface disposed around the trunnion member; and

second annular bearing structure fixedly mounted in the housing, the second annular bearing structure slidably engaging the partially spherical surface of the first bearing structure to permit the roll axis to swing within an acute angle with respect to the fixed axis of the trunnion member as the roll is rotating.

10. In a galvanizing roll assembly as defined in claim 9, including:

2 a plurality of elongated rollers disposed between said  
3 bearing structures, the rollers each having a longitudinal axis supported parallel  
4 to the trunnion axis; and

5 a roller carrier having an elongated recess for receiving  
6 each of the rollers for rotation within a respective recess, the roller carrier being  
7 connected to one of said bearing structures such that the rollers roll with the  
8 other of said bearing structures.

1 11. In a galvanizing roll assembly as defined in claim 9, in which the  
2 bearing means is carried within the roll.

1 12. In a galvanizing roll assembly as defined in claim 9, in which the  
2 rollers form a multiple line bearing contact between said bearing structures.

1 13. In a galvanizing roll assembly, including:  
2 a rotatable rotating roll;  
3 a trunnion shaft carried on the roll, so as to be rotatable  
4 therewith;  
5 a self-aligning bearing means mounted on the arm for  
6 supporting the roll for rotation comprising:  
7 a housing;  
8 first annular bearing structure movably mounted in  
9 the housing and having a cylindrical inner surface of a low friction material

10 slidably mounted on the trunnion shaft, and an outer surface having an annular  
11 partially spherical bearing surface disposed around the trunnion shaft;  
12 second annular bearing structure fixedly mounted in  
13 the housing and having a fixed bearing axis, the second annular bearing  
14 structure slidably engaging the partially spherical surface of the first bearing  
15 structure to permit the roll axis to swing with respect to the fixed bearing axis.

1 14. In a galvanizing roll assembly as defined in claim 13, including:

2 the trunnion shaft having a trunnion axis;

3 a plurality of elongated rollers disposed between said  
4 bearing structures, the rollers each having a longitudinal axis supported parallel  
5 to the trunnion axis; and

6 a roller carrier having an elongated recess for receiving  
7 each of the rollers for rotation within a respective recess, the roller carrier being  
8 connected to one of said bearing structures such that the rollers roll with the  
9 other of said bearing structures.

1 15. A galvanizing roll assembly intended to be submerged in molten  
2 metal, comprising:

3 an arm;

4 a strip-engaging roll having a trunnion;

5 a self-aligning bearing supporting the trunnion on the arm,  
6 said self-aligning bearing including a roller-bearing,

said arm, said roll and said self-aligning bearing each comprising alloy materials that present low solubility with a particular molten metal in which they are to be submerged and having a high hardness,  $R_c > 25$ , at the molten metal operating temperature;

the trunnion member having an outer cylindrical bearing surface;

the arm assembly having a bearing housing member having an opening with an inner cylindrical bearing surface, for receiving the trunnion member in a generally coaxial position;

the trunnion member having a trunnion axis;

a plurality of elongated rollers disposed between the trunnion member and the bearing housing member, the rollers each having a longitudinal axis supported parallel to the trunnion axis;

a roller carrier having an elongated recess for receiving each of the rollers for rotation within a respective recess, the roller carrier being connected to one of said members such that the rollers roll with the other of said members; and

each of the recesses having an open, partially cylindrical recess wall, each of the rollers having a cylindrical wall, and including an annular clearance between each of the rollers and its respective recess wall for passing a hydrodynamic lubricating molten metal film between the roller and the recess wall as the roller is being rotated in a bath of a molten metal.



1            16.    A galvanizing roll assembly as defined in claim 15, in which the  
2 alloy materials comprise by weight:

Percent		
.30	< Carbon <	1.80
0.0	< Chromium <	12.0
3.0	< Tungsten <	14.0
3.0	< Molybdenum <	14.0
20.0	< Iron <	50.0
0.0	$\leq$ Vanadium <	4.0
0.0	$\leq$ Niobium <	4.0
4.0	$\leq$ Cobalt <	20.0
0.0	$\leq$ Boron <	1.0
0.0	$\leq$ Manganese $\leq$	1.0
0.0	< Silicon <	3.0

1            17.    In a galvanizing roll assembly including a supporting arm, a roll  
2 rotatable about a roll axis, a bearing apparatus useful for supporting the roll for  
3 transferring a heated steel strip in a bath of molten zinc, molten aluminum or  
4 mixtures thereof, said bearing apparatus comprising:  
5                    structure on the roll having a bearing opening;  
6                    a trunnion;

7                    an arm supporting the trunnion in a fixed position with  
8    respect to the arm, the trunnion being rotatably receivable in the bearing  
9    opening to support the roll for rotation with respect to the arm.

1            18.    In a galvanizing roll assembly as defined in claim 17, in which the  
2    roll has an end opening, and the bearing apparatus is supported in said end  
3    opening.

1            19.    A galvanizing roll assembly as defined in claim 4, in which the  
2    molten metal film forms a cushion between the roller and the recess wall.

1            20.    In galvanizing roll assembly as defined in claim 17, including a  
2    wear sleeve mounted on the trunnion in the bearing opening.